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THE EFFECT OF DIFFERENT TIMES COLLECTING CUTTING, GROWING CONDITIONS AND AUXIN TREATMENTS OF THE ROOTING IN PHALSA (*GREWIA ASIATICA* L.) STEM CUTTING UNDER VALLY CONDITION OF GARAHWL

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Abstract

This study was carried out to determine the effect of different times collecting cutting and auxin treatments of the rooting in phalsa (*Grewia asiatica* L.) stem cutting under different growing condition was studied in the Horticulture Research Center, Department of Horticulture, Chauras Campus, H.N.B. Garhwal Central University, Srinagar (Garhwal), Uttarakhand, India during the year 2012. The treatments included Six Time of Planting (January, February, March, June, July and August), two growing condition (Shade house and Mist chamber) and three IBA concentrations (1000, 1500, 2000 ppm) alongwith a control (distrilled water). For preparing the rooting media, sandy soil and farm yard manure (FYM) in ratio of 1:1 by v/v were mixed thoroughly, cleaned for stones and grasses, then the mixture was filled in root trainers. The experiment was laid out in Split Split Plot Design (SSPD) with three replications. Phalsa (*Grewia asetica* L.) propagated through hardwood cuttings show maximum success of cuttings in August month planting time and mist chamber growing condition while, IBA 2000 ppm gives most effective success rate of cuttings.

Key words : Phalsa, stem cutting, IBA, growing condition and planting time.

Introduction

Phalsa (*Grewia asetica* L.) is an important minor fruit crop of India. Phalsa belongs to family Tiliaceae. The edible part of fruit varies from 69 to 93%. Ripe phalsa fruits are sub acidic and good source of vitamin 'A' and 'C'. They are fair source of phosphorous and iron. Fruits contain 50-60 per cent juice, 10-11 per cent sugar and 2.0 to 2.5 per cent acid.

The Phalsa plant is readily propagated by rooting of hardwood cuttings as well as layering (Samson, 1986). Rooting of phalsa cutting depends on various factors such as pretreatment of cutting, growing condition, environmental factors, etc. which influence the regeneration ability of cuttings (Jadhav, 2007). Although, phalsa can strike roots but rooting is not appreciable. Growth regulators are to be used to improve its high rooting ability (Yadav and Rajput, 1969). Application of auxin, particularly indole – 3 – butyric acid (IBA), is one of the most common and effective means to enhance rooting of cutting (Hartman *et al*., 2011). Adventitious root formation can be stimulated by auxins, but their role in rooting is not exclusive and others compounds are involved (Gaspar *et al.*, 1997). Mancuso (1998) showed a marked seasonal variation in rooting ability of cuttings, achieving the highest (80%) rooting in spring–summer and the lowest (20–30%) rooting in winter. Many plant and environmental factors, including genotypes, nutritional status, phenological stage and environmental conditions determine seasonal variations in rooting ability of woody cuttings (Hartmann *et al*., 1990). Hence, it is possible that optimum use of growth regulators and suitable season would help for rapid multiplication in propagating phalsa cuttings. Rooting efficiency would be better when, it is done in control conditions such as mist chamber.

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Materials and Methods

The experiment site was conducted under mist chamber at Horticulture Research Center, Chauras Campus. Geographically Srinagar valley is spread between latitude 30^0, 12' 0" to 30^0 13' 4" North and longitude 78^0 0' 45" to 78^0 0' 50" East. The valley is about 6 km long and 1 to 1.2 km wide located on both side of famous Alaknanda river at an elevation 540 m above MSL and about 132 km from Haridwar in Himalayan region. The valley shows a semi-arid and sub-tropical climate. Except during rainy season rest of months are usually dry with exception occasional showers during winter or early spring. The average minimum and maximum temperature, relative humidity and rainfall vary from 7.42^0c to 35.3^0, 60.24% and 2.50 to 235.24 mm, respectively. Hardwood cuttings of *Grewia asiatica* were collected from 4 to 5 year old plants and 15 cm long cuttings with basal portion. Cuttings were planted January, February, March, June, July and August 2012, treated with IBA concentration 1000, 1500, 2000 ppm under two growing condition shade house and mist chamber. For preparing the rooting media, sandy soil and farm yard manure (FYM) in ratio of 1:1 by v/v were mixed thoroughly, cleaned for stones and grasses, then the mixture was filled in root trainers. The experiment was laid out in SSPD and replicated thrice with 10 cuttings in each treatment. The basal 1.5-2.0 cm portion of the cuttings was dipped in growth regulator formulation for 10 minutes and immediately planted in medium to a depth of 6-8 cm. The planted cuttings were allowed to root for 90 days. The cuttings (nine numbers per treatment per replication) were carefully removed from the pots and dipped in water to remove the soil particles adhering to roots to record the observations pertaining to roots *viz*., percentage of cutting rooted, length of longest root, diameter of root and Secondary rooting except for the observations on various stem leaf characters and all other were recorded after planting.

Results and Discussion

The rooting response of Phalsa (*Grewia asiatica* L.) cuttings treated with planting time in showed in table 1. Average maximum number of sprouted cutting (6.62), length of longest sprout (5.78 cm), diameter of sprout (1.25 mm), number of leaves (4.57), rooting percentage (44.58), length of longest root (6.54 cm), diameter of root (1.34), percentage of secondary rooting (63.88), fresh weight of root (0.91 g) and dry weight of root (0.74) was recorded under mid August planting time while the minimum number of sprouted cutting, length of longest sprout, diameter of sprout, number of leaves, rooting percentage, length of longest root, diameter of root, percentage of secondary rooting , fresh weight of root and Dry weight of root (0.00) was observed under mid January, February and March planting time. This may be affected by season and several factors such as temperature, light and nutrient availability to the survival percentage of cuttings. It may be depends on species, favourable climatic conditions to the percentage of sprouted cuttings. Shafrir and Mendel (1970) found that the rooting behavior of cuttings varied with the seasons, low temperature adversely affecting rooting. Poor rooting in the cuttings which were planted during cooler time of the season might be due to the fact that these cuttings might have been carrying higher inhibitor to promote ratio or it might be due to higher nitrogen to carbohydrate ratio. The low rooting percentage during winter may be attributed to temperature level at the time of planting. Evans (1992) observed that probably the best time to take cuttings from the field is at the beginning of the rainy season. Singh *et al*. (1961) recorded that the hardwood cuttings produced a higher rooting percentage with vigorous root system then semi hardwood cuttings. They all so noted that the best time for taking cutting in phalsa was July august than in September. In propagating deciduous species, hardwood and semi-hardwood cuttings can be taken during the dormant season when buds are not active and before buds start to force out in the rainy season. There is an optimal period for rooting many species, which is necessary to maximize the rooting process (Hartman *et al*., 1997). The present findings are similar to the findings of Kumar *et al*. (2007) in phalsa.

In case of the growing conditions significantly the average maximum number of sprouted cutting (3.69), length of longest sprout (3.50cm), diameter of sprout (0.76 mm), number of leaves (2.55), rooting percentage (26.94), length of longest root (4.12 cm), diameter of root (0.71), percentage of secondary rooting (37.19), fresh weight of root (0.52 g) and dry weight of root (0.36) was observed under mist Chamber growing condition while the minimum number of sprouted cutting (1.50), length of longest sprout (0.99), diameter of sprout (0.25 mm), number of leaves (0.76), rooting percentage (4.44), length of longest root (1.06 cm), diameter of root (0.25 mm), percentage of secondary rooting (12.03), fresh weight of root (0.15 g) and dry weight of root (0.08 g) was recorded under shade house growing condition. Intermittent mist is often used on cuttings because it reduces the temperature of the leaves, lowers respiration, and increases relative humidity around the leaf surface (Langhans, 1955). Vijaya Kumar (1973) showed that rooting of cuttings was higher under intermittent mist than under continuous for mist obtained

Table 1 : Effect of planting time on the rooting and survival performance of phalsa

Treatments	Number of sprouted cutting	Length of longest sprout (cm)	Diameter of sprout (cm)	Number of leaves	Rooting Percen-tage	Longest root length (cm)	Root diameter (cm)	Secondary rooting (%)	Fresh weight of root (g)	Dry weight of root (g)
January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
March	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
June	1.79	3.47	0.68	2.32	17.91	3.77	0.68	35.18	0.38	0.21
July	3.16	4.22	1.12	3.08	31.66	5.23	0.88	48.60	0.74	0.39
August	6.62	5.78	1.25	4.57	44.58	6.54	1.34	63.88	0.91	0.74

Table 2 : Effect of growing conditions on the rooting and survival performance of phalsa.

Treatments	Number of sprouted cutting	Length of longest sprout (cm)	Diameter of sprout (cm)	Number of leaves	Rooting Percen-tage	Longest root length (cm)	Root diameter (cm)	Secondary rooting (%)	Fresh weight of root (g)	Dry weight of root (g)
Shade house	1.50	0.99	0.25	0.76	4.44	1.06	0.25	12.03	0.15	0.08
Mist chamber	3.69	3.50	0.76	2.55	26.94	4.12	0.71	37.19	0.52	0.36

Table 3 : Effect of IBA concentrations on the rooting and survival performance of phalsa.

Treatments	Number of sprouted cutting	Length of longest sprout (cm)	Diameter of sprout (cm)	Number of leaves	Rooting Percen-tage	Longest root length (cm)	Root diameter (cm)	Secondary rooting (%)	Fresh weight of root (g)	Dry weight of root (g)
1000 ppm	1.52	1.91	0.34	1.57	15.27	2.76	0.36	24.69	0.37	0.26
1500 ppm	1.83	2.38	0.52	1.74	17.77	2.78	0.51	26.85	0.35	0.22
2000 ppm	4.47	4.60	0.91	2.60	24.16	4.04	0.81	38.57	0.54	0.37
Control	0.55	1.09	0.25	0.73	5.55	0.77	0.25	8.33	0.09	0.04

successful rooting of guava cuttings under intermittent mist with IBA at 5000 ppm concentration it has been further established that when the mist propagation was coupled with certain hormonal treatments, the cuttings gave better rooting than with mist alone. Chauhan and Reddy (1974) observed that rooting was highest (17.46%) in stem cutting of plum (*Prunus domestica*) under intermittent mist as compared to 9.8 percent without mist. Selvarajan and Madhava Rao (1982) reported that mist chamber provides most favorable environment for better rooting of patchouli cuttings. These findings are agreed with the findings of Saroj *et al*. (2007) in pomegranate (table 2).

In case of the IBA concentration significantly the average maximum number of sprouted cutting (4.47), length of longest sprout (4.60cm), diameter of sprout (0.91 mm), number of leaves (2.60), rooting percentage (24.16), length of longest root (4.04 cm), diameter of root (0.81), percentage of secondary rooting (38.57), fresh weight of root (0.54 g) and Dry weight of root (0.37) was observed under 2000 ppm concentration of IBA while the minimum number of sprouted cutting (0.55), length of longest sprout (1.09 cm), diameter of sprout (0.25 mm), number of leaves (0.73), rooting percentage (5.55), length of longest root (0.77 cm), diameter of root (0.25 mm), percentage of secondary rooting (8.33), fresh weight of root (0.09 g) and Dry weight of root (0.04 g) was recorded under control treatment. Interaction between planting time, growing condition and treatment was found significant. The better percentage of survival cuttings with optimum time and IBA treatments might be ascribed due to better root growth which augmented absorption and translocation of nutrients from soil which take active part in various plant metabolic processes (Singh, 2001c). Majeed *et al*. (2009) recorded the highest rooting rate (50%) for *Aesculus indica* cuttings treated with IBA at 2000 ppm. It may be due to the action of auxin which might have caused hydrolysis and translocation of carbohydrates and nitrogenous substances at the base of

Table 4 : ANOVA for planting time, growing condition Phalsa cuttings treated with four IBA concentrations.

	df	Number of sprouted cuttings	Length of longest sprout (cm)	Diameter of sprout (cm)	Number of leaves	Rooted %	Longest root length (cm)	Root diameter (cm)	Secondary rooting (%)	Fresh weight of root (g)	Dry weight of root (g)
Replicates	2.00	0.92	1.14	0.04	0.32	63.19	2.50	0.10	11.14	0.03	0.03
Planting Month	5.00	92.74***	158.98***	8.37***	92.33***	8801.11***	212.25***	7.86***	19427.35***	4.06***	2.15***
Error (A)	10.00	0.56	0.42	0.05	0.36	32.36	1.16	0.07	91.43	0.02	0.02
Growing Condition	1.00	173.36***	226.13***	9.24***	115.47***	18225.00***	336.45***	7.79***	22777.60***	4.82***	2.68***
Planting Month*Condition	5.00	35.94***	55.79***	2.21***	26.43***	3796.67***	74.81***	2.09***	6062.21***	1.25***	1.05***
Treatment	3.00	22.94***	39.57***	3.12***	20.96***	2149.07***	66.02***	2.13***	5581.64***	1.21***	0.66***
Planting Month*Treatment	15.00	5.96***	9.64***	0.86***	6.73***	542.96***	17.12***	0.62***	1593.90***	0.34***	0.23***
Condition*Treatment	3.00	4.86***	1.55**	0.06 NS	0.69NS	549.07***	11.69***	0.09NS	759.90***	0.19***	0.15***
Planting Month*Condition *Treatment	15.00	1.44***	6.75***	0.51***	1.52***	151.85***	6.75***	0.26***	545.86***	0.16***	0.12***
Error (C)	84.00	0.40	0.31	0.03	0.34	30.36	0.72	0.06	58.43	0.02	0.01
Total	143.00	7.36	11.90	0.67	6.51	718.40	17.06	0.58	1448.89	0.31	0.19
General Mean	-9.00	1.60	2.25	0.51	1.66	15.69	2.59	0.48	24.61	0.34	0.23
C.V.	-9.00	46.72	28.69	43.66	36.22	36.25	41.43	53.81	38.85	45.62	61.58
C.D. 95%	-9.00										
Ai.- Aj. (Planting Month)	-9.00	0.48	0.41	0.14	0.39	3.66	0.69	0.17	6.15	0.10	0.09
Bi.- Bj. (Growing Condition)	-9.00	0.21	0.18	0.06	0.19	1.83	0.28	0.08	2.53	0.04	0.03
AiBi-AiBj	-9.00	0.52	0.45	0.15	0.47	4.47	0.69	0.20	6.21	0.11	0.08
AiBi-AjBi	-9.00	0.60	0.52	0.18	0.51	4.83	0.85	0.22	7.54	0.13	0.11
Ci.- Cj. (Treatment)	-9.00	0.30	0.26	0.08	0.27	2.58	0.40	0.11	3.58	0.06	0.05
AiCi-AiCj	-9.00	0.73	0.64	0.21	0.67	6.33	0.98	0.28	8.78	0.15	0.12
AiCi-AjCi	-9.00	0.79	0.69	0.23	0.69	6.58	1.09	0.30	9.76	0.16	0.14
BiCi-BiCj	-9.00	0.42	0.37	0.12	0.39	3.65	0.56	0.16	5.07	0.09	0.07
BiCi-BjCi	-9.00	0.42	0.37	0.12	0.39	3.65	0.56	0.16	5.07	0.09	0.07

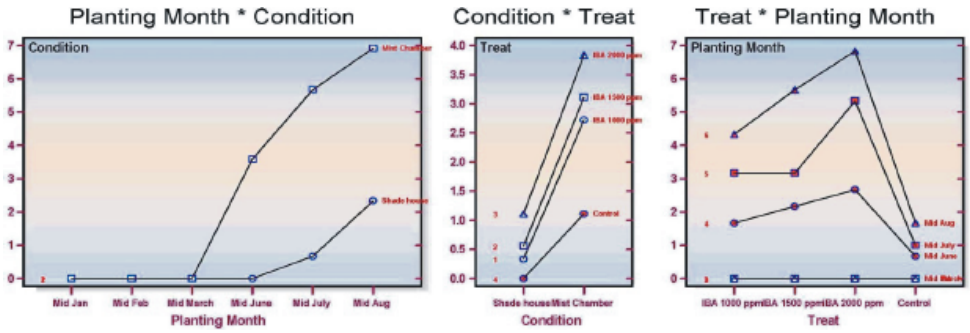

Fig. 1 : Interaction between planting time, growing condition and treatment IBA on the number of sprouted cutting.

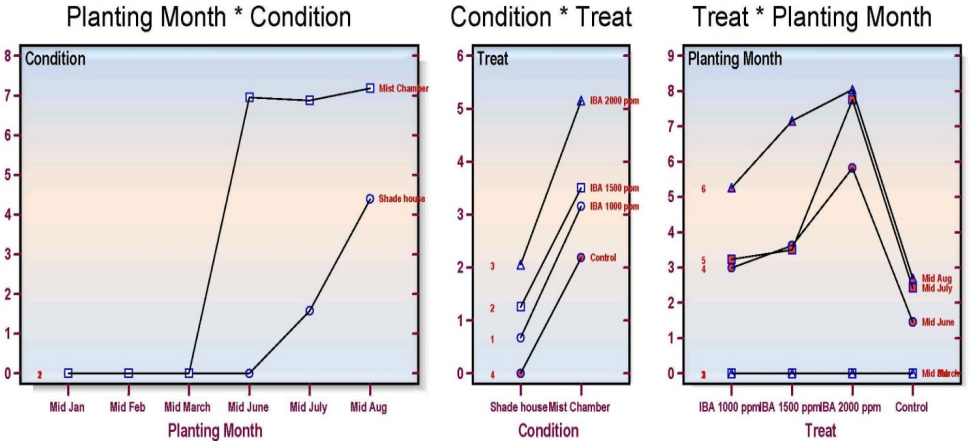

Fig. 2 : Interaction between planting time, growing condition and treatment IBA on the length of longest sprout (cm).

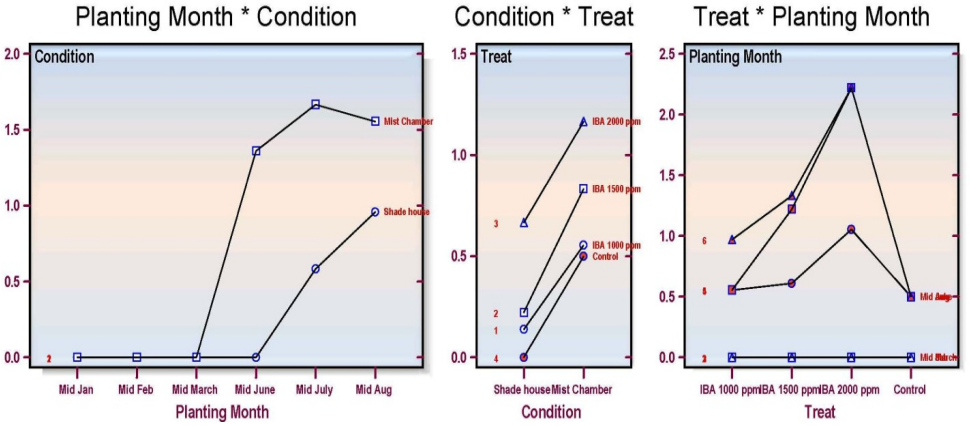

Fig. 3 : Interaction between planting time, growing condition and treatment IBA on the diameter of sprout (cm).

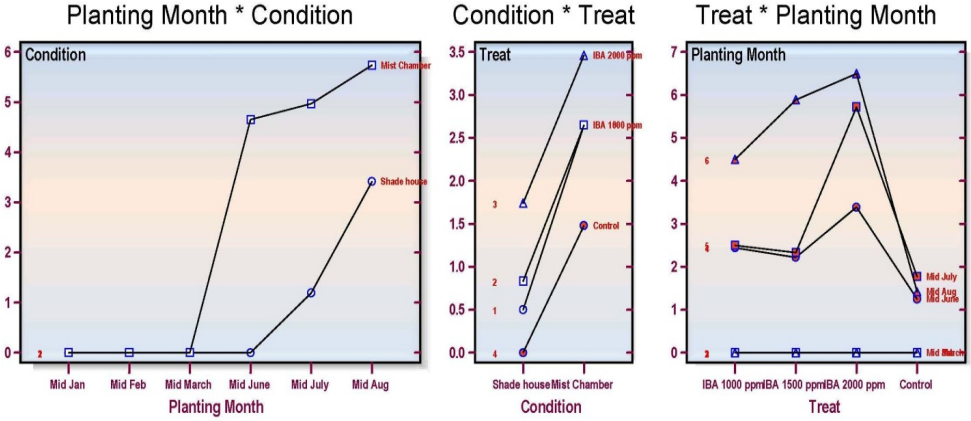

Fig. 4 : Interaction between planting time, growing condition and treatment IBA on the number of leaves.

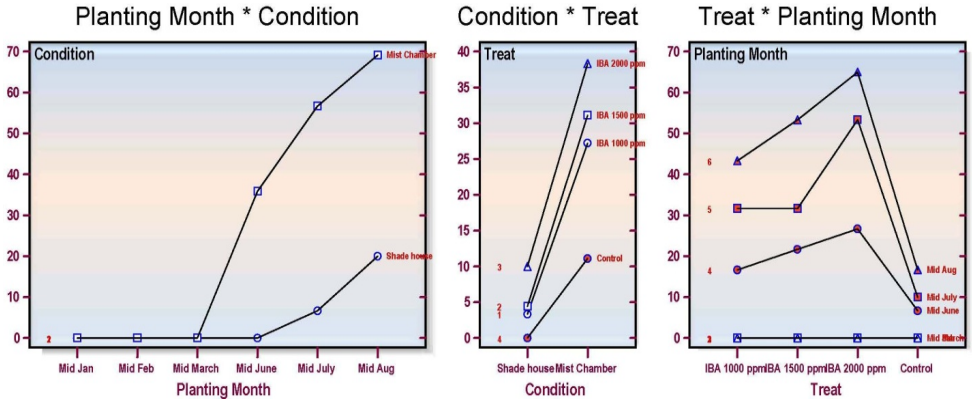

Fig. 5 : Interaction between planting time, growing condition and treatment IBA on the Rooting Percentage.

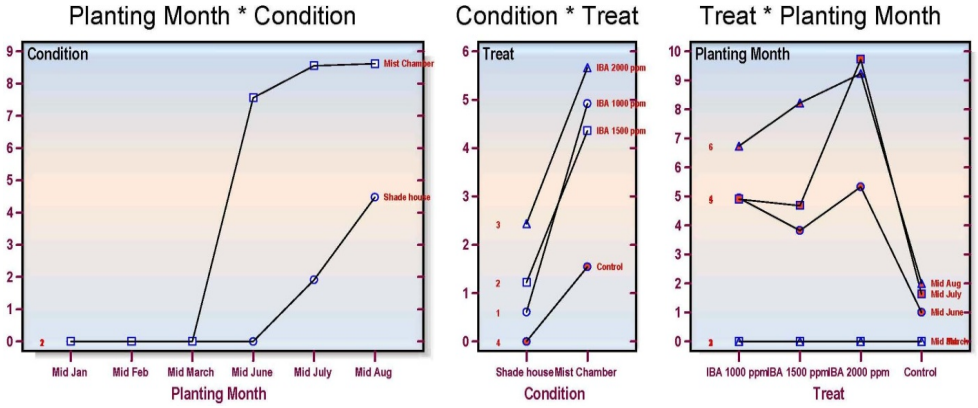

Fig. 6 : Interaction between planting time, growing condition and treatment IBA on the longest root length.

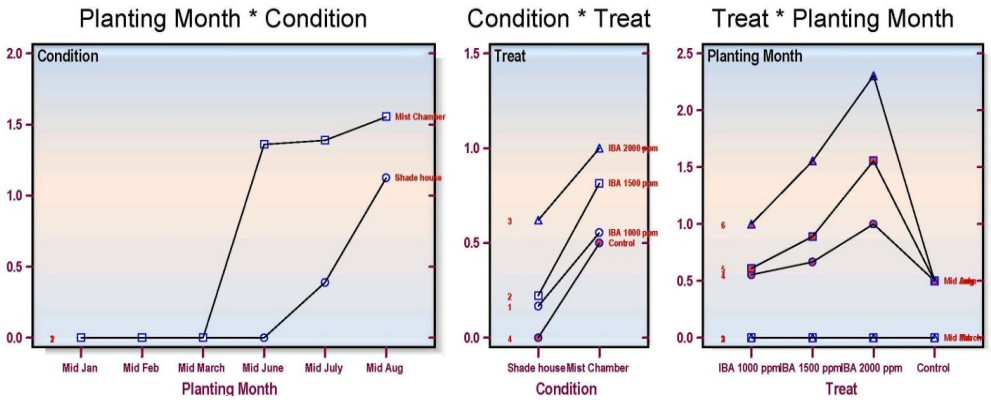

Fig. 7 : Interaction between planting time, growing condition and treatment IBA on the Root diameter.

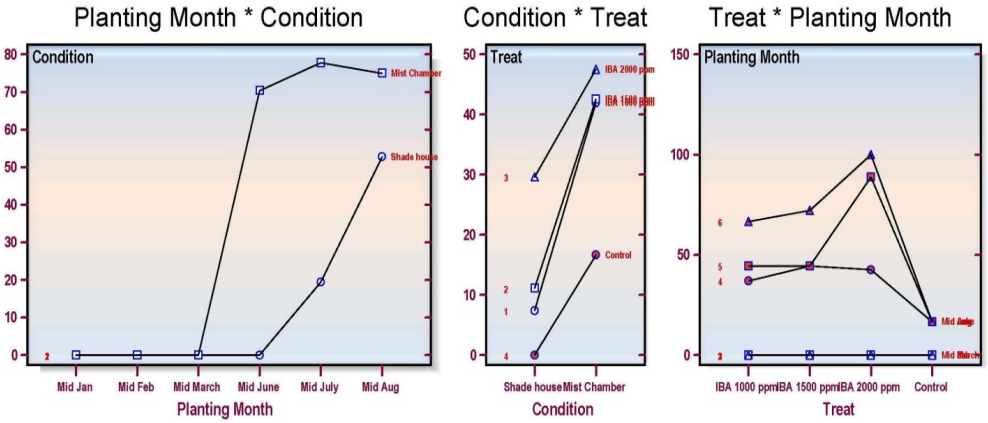

Fig. 8 : Interaction between planting time, growing condition and treatment IBA on the Percentage of secondary rooting.

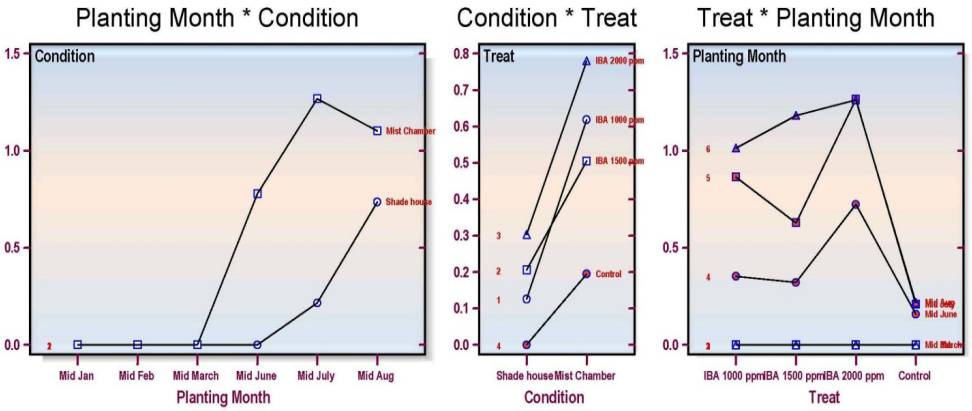

Fig. 9 : Interaction between planting time, growing condition and treatment IBA on the fresh weight of root.

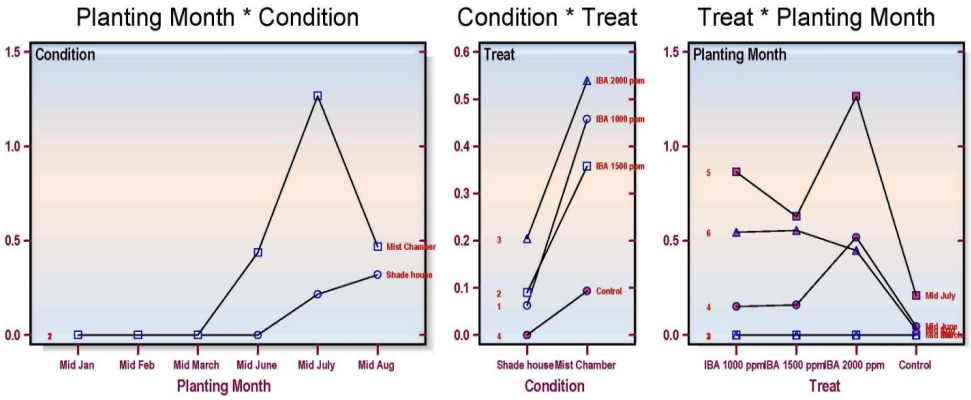

Fig. 10 : Interaction between planting time, growing condition and treatment IBA on the dry weight of root.

cuttings and resulted in accelerated cell elongation and cell division in suitable environment (Hartmann *et al*., 2007). Auxin application has been found to enhance the histological features like formation of callus and tissue and differentiation of vascular tissue (Mitra and Bose, 1954). Adding a small percentage of certain phenoxy compounds to either IBA or NAA increased rooting and produced root systems better than those obtained when phenoxy compounds are used alone (Davis and Haissig, 1990). The findings of Shrivastava (1996) in phalsa, Singh *et al.* (2014) in malberry and Singh *et al.* (2011) in bougainvillea are similar to present results (table 3).

Conclusion

In light of the results obtained and discussion given above, it can be concluded that hardwood cutting of phalsa treated with 2000 ppm concentration of IBA, Mist chamber growing condition and August planting time gives the overall best performance.

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